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Urban and Rural Physicians: Considerations for Medicare Payment Reform

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Project Report

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16. Abstract (Limit: 200 words)

This is a comprehensive descriptive comparison of urban and rural physicians using 1986 American Medical Association (AMA) Socioeconomic Monitoring System Survey data. The authors consider whether differences between urban and rural physicians have significant implications for Medicare physician payment reform. Physicians are categorized into three county types: Metropolitan, adjacent, and outlying. Additionally, physicians are examined by high and low levels of Medicare involvement. The degree of Medicare involvement is measured by the percentage of revenue obtained from Medicare. The physician characteristics studied include: specialty, board certification, solo practice, utilization, fees, expenses, income, Medicare participation and assignment, and sources of revenue. Statistical comparisons between urban and rural physicians are based on t-tests for differences between means and multiple regression.

There are a number of significant differences found between urban and rural physicians. Consistent with other research, urban physicians are more specialized than rural physicians. Analysis of utilization (measured as patient visits) indicates that rural physicians have higher Medicare patient volumes and balance bill more than urban physicians. Because of these differences, Medicare physician reform may have a mixed effect on rural physicians. For example, given the specialty make-up in rural counties, the relative value scale should increase rural fees. On the other hand, higher Medicare patient volume in rural areas may place a greater proportion of rural physician practices under volume performance standards and under the new limits on balance billing.

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ABSTRACT

This paper considers whether differences between urban and rural physicians have significant implications for Medicare physician payment reform. We undertake a comprehensive comparison of urban and rural physicians using 1986 AMA data. Physicians are categorized into three county types: metropolitan, adjacent, and outlying. Additionally, we examine physicians with high and low levels of Medicare involvement. The physician characteristics studied include: specialty, board certification, solo practice, utilization, fees, expenses, income, Medicare participation and assignment, and sources of revenue. Statistical comparisons between urban and rural physicians are based on t-tests for differences between means and multiple regression.

There are a number of significant differences between urban and rural physicians. Consistent with other research, we find that urban physicians are more specialized than rural physicians. Our analysis of utilization (measured as patient visits) indicates that rural physicians have higher Medicare patient volumes. We also find that rural physicians balance bill more than urban physicians. We conclude that because of these differences, Medicare physician reform is likely to have a more consequential effect on rural physicians and the impact could be mixed in rural areas. For example, given the specialty make-up in rural counties, the relative value scale should increase rural fees. On the other hand, higher Medicare patient volume in rural areas will place a greater proportion of rural physician practices under volume performance standards and under the new limits on balance billing.

I. INTRODUCTION

The recently enacted Medicare physician payment reforms include a fee schedule requiring that payment rates be adjusted to reflect geographic differences in the costs of malpractice insurance, other practice expenses, and physician time. This represents a major departure from the customary, prevailing, and reasonable (CPR) methodology under which Medicare essentially allowed local market conditions to establish geographic fee differentials. The CPR approach led to fees that were substantially lower, on average, in rural areas than in urban areas. However, recent evidence suggests that most of these differences can be explained by differences in the cost of practice (Pope, Welch, Zuckerman, and Henderson, 1989).

Nonetheless, some have argued that Medicare payment policies have made it difficult for rural areas to attract and retain an adequate supply of physicians, the lower fees being inadequate compensation for physicians locating their practices in remote areas. Contrary to this conclusion, studies have shown that as the numbers of physicians grow and specialization increases, physicians will move into rural areas (Newhouse et al., 1982; Schwartz et al., 1980; Williams et al., 1983). However, whether this diffusion of physician supply will occur quickly enough or thoroughly enough to improve access for most rural residents remains a debated issue (Fruen and Cantwell, 1982; Hynes and Givner, 1983; Kindig and Movassaghi, 1989).

Policymakers assume that higher relative fees in rural areas will help assure access and may increase physician supplies. Recent examples of this can be found in the 1989 and 1990 Omnibus Budget Reconciliation Acts which provide

Medicare bonus payments to physicians practicing in Health Manpower Shortage Areas (HMSAs). Congress is also attempting to reduce geographic fee differentials as part of Medicare physician payment reform by recognizing only one-quarter of the difference in the cost of physician time in computing geographic adjustment factors. This will increase the redistribution in Medicare revenues from urban to rural physicians relative to an adjustment that fully recognizes these cost differences (PPRC, 1989 p.119-129).

In light of the heightened interest in payments to physicians in rural areas, we provide a descriptive analysis of the differences between urban and rural physicians. Among other characteristics, we compare physicians in terms of specialization, utilization, practice expenses, income, and Medicare involvement. In addition to providing a general picture of urban and rural providers, we identify aspects that are of particular concern to Medicare policymakers. For example, we compare current differences in assignment and balance billing behavior. If balance billing is more prevalent in rural areas, then the new limits on balance billing could offset the favorable treatment rural areas received under the new fee schedule's geographic adjustment factors.

II. DATA AND METHODS

The data for this analysis are drawn from the 1986 American Medical Association's (AMA) Socioeconomic Monitoring System (SMS) survey. The survey of nonfederal patient care physicians provides data on a range of medical practice characteristics such as earnings, expenses, work patterns, and fees. All responses to this survey pertain to 1986, with the exception of income and expenses which pertain to 1985. The physician sample is not limited to physicians with AMA membership, but excludes residents, doctors of osteopathy, and foreign medical graduates (FMGs) who are temporarily in the U.S. The

sample is stratified by specialty and region to assure that it is representative along these dimensions. The response rate to the survey was 66 percent, yielding a sample of 4,011 physicians.

For this study, physicians are classified by location and degree of Medicare involvement. To categorize physicians by location, 1980 Human Resource Profile County (HRPC) codes, established by the Office of Management and Budget, are assigned to each physician in our sample. We then collapse nine HRPC codes into three categories: metropolitan (MSA), nonmetropolitan adjacent to an MSA, and nonmetropolitan nonadjacent to an MSA. Exhibit 1 provides a more complete definition of our location categories. For expositional purposes the three county classifications are referred to as "urban", "adjacent", and "outlying", respectively. As a group, physicians in adjacent and outlying counties are referred to as "rural".

The degree of Medicare involvement (referred to as "Medicare dependency") is measured by the percentage of revenues obtained from Medicare. Just over 78 percent (3,135) of the physician sample reported the percentage of revenues received from Medicare. To facilitate analysis, the physician distribution was divided into thirds based on Medicare revenue. Three categories (high, medium, and low dependency) are a reasonable number of groups for a descriptive analysis of this nature and the distribution of physicians tends to cluster into three groups. In the first group (30 percent of physicians), Medicare accounts for 9 percent or less of revenues; the second group (30 percent of physicians) contains physicians for whom Medicare accounts for between 10 and 29 percent of revenues; and in the last group (40 percent of physicians), Medicare accounts for 30 percent or more of revenues. Table 1 reports the distribution of physicians by Medicare dependency and location. High Medicare

Exhibit 1

Area Definitions Based on the
1980 Human Resource Profile County Codes

Area Classification	Definition
I. Urban	All counties included in Bureau of Census Metropolitan Statistical Areas (see U.S. Department of Commerce, Bureau of the Census (1984) 1980 Census of Population, Metropolitan Statistical Areas Supplemental Report PC80-S1-18. Washington, D.C.: Department of Commerce for the definition of MSA)
II. Rural	
A. Adjacent	1. Counties contiguous to MSA and having between 20,000 and 50,000 urban residents[a].
	2. Counties contiguous to MSA with less than 20,000 but greater or equal to 2,500 urban residents.
B. Outlying	1. Counties not contiguous to MSA and having between 20,000 and 50,000 urban residents[a].
	2. Counties not contiguous to MSA and having less than 20,000 but not less than 2,500 urban residents.
	3. Counties having less than 2,500 urban residents, not contiguous to MSA.
	4. Counties having less than 2,500 urban residents, contiguous to MSA[b].

a. Generally the upper bound for these counties is 50,000 urban residents. However, there are a few exceptions: a county with more than 50,000 urban residents but with none of these urban residents in a single metropolitan area could be classified in categories A.1 or B.1, depending on proximity to an MSA. There are very few of these exceptions.

b. These counties are adjacent to an MSA but are classified as outlying in order to protect the anonymity of individual physicians who responded to the survey.

Table 1

Medicare Dependency[1] by County Type
(Number and Percentage[2] of Physicians within County Type)

Percentage of Revenues from Medicare	Metropolitan ("Urban")	Nonmetropolitan ("Adjacent")	Nonmetropolitan ("Outlying")	Total
Low 0-9%	830 31.9%	45 22.2%	70 21.1%	945 30.1%
Medium 10-29%	777 29.9	59 29.1	105 31.6	941 30.0
High 30-100%	993 38.2	99 48.8	157 47.3	1249 39.8
Total	2600 100.0	203 100.0	332 100.0	3135 100.0

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

1. Medicare dependency categories are defined by the percentage of revenue received from Medicare.

2. Column percentage totals do not necessarily sum due to rounding.

dependency is more prevalent among adjacent and outlying physicians than among their urban counterparts.

We also categorized physicians by specialty. "Medicare Surgery" includes ophthalmology and orthopedic surgery specialties. Ophthalmology and orthopedic surgery specialties are referred to as "Medicare Surgery" specialties because they account for a relatively high proportion of total Medicare spending. Fisher (1988) finds that in 1986, surgery specialties accounted for 37.3 percent of total physician allowed charges. In that same year, ophthalmology and orthopedic surgery specialties accounted for over 18 percent of total physician allowed charges. "Other Surgery Subspecialties" includes such surgical specialties as: colon and rectal surgery; neurological surgery; plastic surgery; and urological surgery. The "Other Specialty" category is composed of specialties such as pediatrics, obstetrics-gynecology, psychiatry, emergency medicine, and specialties not otherwise classified.

In this study we explore geographic differences related to specialty, board certification, practice organization, employment status, hours worked, patient contacts (surgeries and visits), fees, income, expenses, Medicare participation and assignment, Medicare reimbursement generosity, and the distribution of third-party revenues. Mean values for each of these variables are arrayed in tables by county type or by county type and Medicare dependency. Since, with the exception of specialty, all variables can be treated as proportions, we use a simple t-test with a 95 percent confidence level to test for significant differences between urban and rural physicians. The null hypothesis under the t-test is that the categorical means (e.g. urban, adjacent, and outlying) are equal. Because specialty has seven categories, we test for statistical differences using a chi-square test for independence [1].

Results of the statistical tests across location are presented in footnotes to the tables that follow. In order to avoid confusion in the presentation of results, standard errors are not included in the tables. However, for readers interested in deriving t-values, standard errors for each mean are reported in a corresponding table in Appendix A.

Of our sample, 3,358 physicians are in metropolitan counties, 260 are in nonmetropolitan adjacent, and 393 are in nonmetropolitan nonadjacent counties. We recognize that the sample for adjacent and outlying counties is small and that our significance tests are sensitive to sample size. Small sample sizes reduce the probability of rejecting the null hypothesis. Thus we feel that the statistically significant results reported below are the most conservative. However, the combination of a single year of data and small sample sizes argue that the results should be treated as suggestive rather than definitive. Further refinement of the relationships between urban and rural physicians could be established with an over-sampling of rural physicians or by pooling multiple years of data.

III. RESULTS

Table 2 shows that there are substantial differences in specialty across county types. Rural physicians—in both adjacent and outlying counties—are less likely to specialize in medical specialties or other surgical subspecialties than urban physicians. Rural physicians are much more likely to be in general practice than urban physicians. Only 12.7 percent of urban physicians are general practitioners as compared with approximately 33 percent in rural counties. Among surgeons, the greatest difference is between urban and outlying counties. Despite having the same proportion of their physician

Table 2

Specialty, Board Certification, Type of Practice, and Employment Status
Distribution of Physicians by County Type

	Metropolitan ("Urban")	Nonmetropolitan Adjacent ("Adjacent")	Nonmetropolitan Nonadjacent ("Outlying")	Total
Physician Specialty[1]				
General Practice/ Family Practice	12.7%	33.5%	31.8%	15.9%
Internal Medicine/ Medical Specialties	17.8	11.5	12.5	16.9
General Surgery	4.9	5.8	9.4	5.4
Medicare Surgery	7.3	5.8	5.3	7.0
Other Surgery Subspecialties	8.1	5.8	5.6	7.7
Rad/Anesth/Path (RAPs)	16.3	14.2	13.5	15.9
Other Specialty	33.0	23.5	21.9	31.3
SAMPLE SIZE	3358	260	393	4011
Board Certification				
Certified	70.2%[bc]	58.1%[a]	61.3%[a]	68.5%
SAMPLE SIZE	3358	260	393	4011
Type of Practice				
Solo Practice	39.7%[b]	46.5%[a]	43.5%	40.5%
SAMPLE SIZE	3358	260	393	4011
Employment Status				
Self-Employed	73.2%[bc]	83.1%[a]	80.7%[a]	74.6%
SAMPLE SIZE	3358	260	393	4011

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

1. Medicare surgery includes ophthalmology and orthopedic surgery. Other surgery subspecialties includes such subspecialties as colon and rectal; neurological; plastic; and urological surgery. Other specialty includes such specialties as pediatrics; obstetrics-gynecology; psychiatry; and emergency medicine. Specialty differences across county type are statistically significant based on a chi-squared test of independence.

a. Mean is statistically different from Urban mean at 95 percent confidence level.
b. Mean is statistically different from Adjacent mean at 95 percent confidence level.
c. Mean is statistically different from Outlying mean at 95 percent confidence level.

populations composed of surgeons (20.2 percent), urban counties are more frequently served by ophthalmologists, orthopedists, and other surgical subspecialties than are outlying counties. Outlying counties have a higher proportion of general surgeons.

One point is immediately clear from these results—location and specialty are strongly related. Because of this relationship, simple displays of physician characteristics by location may be misleading unless they control for specialty. Rather than adjusting the sample means for differences in specialty composition, we establish that significant differences across county types are not simply due to specialty. To do this, we regress each physician characteristic being studied on location, specialty, and a set of other relevant control variables. Other relevant variables include age, sex, board certification, solo practice, percentage of fee covered by Medicare, and medical school. Our objective is not to test hypotheses but to subject the observed differences presented in the descriptive analysis without controls to a more robust statistical test. If the location variables are significant in the regression equation, we conclude that there are significant geographic differences beyond those related to specialty. A complete discussion of the regression methods and the results can be found in Appendix B.

Board certification, type of practice, and employment status variations are also documented in Table 2. In urban counties, 70 percent of physicians are board certified as compared with approximately 60 percent in rural counties. Board certification, of course, will tend to be is associated with specialty and, therefore, the board certification differentials reflect the specialty patterns, e.g., the lowest proportion of GPs in urban areas. This descriptive analysis finds that physicians in adjacent counties are

significantly more likely to be organized in solo practice (46.5 percent) than are urban physicians (39.7 percent). However, our regression analysis indicates that once specialty is controlled, there is no difference in rates of solo practice across location (see Table B.2). Data not shown in the table indicate that when urban physicians set up a group practice, it tends to be larger than those in rural counties. The average group practice size in urban counties is 5.5 physicians, approximately one physician more than the average in rural counties. The data also show that urban physicians are less likely to be self-employed (i.e. full or part-owners of their practices).

We next examined styles of medical practice, that is, hours worked per week and numbers of patient visits. Our descriptive analysis (not presented in tables) indicates that outlying county physicians work three more hours per week than urban physicians. However, after controlling for specialty, our regression analysis indicates the difference in average number of hours worked per week is not significant (see Table B.3). There is a small but significant difference in the proportion of time spent in patient care versus administrative activities (93 percent in rural areas versus 90 percent in urban areas).

On the other hand, there are significant differences in the average number of Medicare patient visits [2]. Table 3 compares the average number of patient visits for Medicare and non-Medicare patients by county type and service setting. Both categories of rural physicians have more Medicare patient visits per week (approximately 48) than their urban counterparts (approximately 33). Our regression analysis supports this finding (see Table B.4). Moreover, the greater volume of Medicare patient visits among rural county physicians is seen across all service settings. We found no significant difference in assists, operations, or total surgeries across county types for Medicare patients.

Table 3

Average Number of Medicare and Non-Medicare Patient Visits Per Week Per Physician for Selected Medical Patient Visits by County Type and Medicare Status

	Metropolitan ("Urban")		Nonmetropolitan Adjacent ("Adjacent")		Nonmetropolitan Nonadjacent ("Outlying")		Total	
	Medicare	Non-Medicare	Medicare	Non-Medicare	Medicare	Non-Medicare	Medicare	Non-Medicare
Surgery								
Assists	.18	.38	.26	.29	.24	.37	.19	.38
Operations	.84	2.02	.95	1.81	.95	1.95	.86	2.00
Total Surgeries	1.02	2.40	1.21	2.10	1.19	2.32	1.05	2.37
Non-Surgery								
Patient visits in emergency room	3.11[b]	8.82	5.44[a]	12.88[c]	3.88	6.97[b]	3.36	8.92
Patient visits on hospital rounds	9.86[c]	15.11	12.51	12.69	13.23[a]	16.27	10.41	15.06
Patient visits in office	17.88[bc]	57.66[c]	26.02[a]	63.65	26.85[a]	65.72[a]	19.43	58.96
Patient visits in other locations	1.82[bc]	.59	3.74[a]	.73	4.02[a]	.92	2.19	.64
Total patient visits - all non-surgical settings	32.67[bc]	82.15	47.71[a]	89.95	47.98[a]	89.88	35.40	83.55
SAMPLE SIZE	2116		187		277		2580	

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

Note: Total surgery and non-surgery category components do not necessarily sum to category totals due to rounding.

a. Mean is statistically different from Urban mean at 95 percent confidence level.
b. Mean is statistically different from Adjacent mean at 95 percent confidence level.
c. Mean is statistically different from Outlying mean at 95 percent confidence level.

Selected fees and physicians' earnings are analyzed in Table 4. Fee differentials are explored through the average fee for three representative visits: follow-up hospital visit, office visit with a new patient, and office visit with an established patient. For all three visits, the fees charged by urban physicians are significantly higher than those charged by rural physicians. The fees charged by adjacent and outlying county physicians are not significantly different from each other. The data show, however, that average annual net income from medical practice does not vary between urban and adjacent counties. The only statistically significant difference in average annual net income is between urban county physicians ($115,324) and outlying county physicians ($99,929). Our regression analysis also finds that urban county physician incomes are higher than outlying physician incomes even after controlling for specialty (see Table B.5).

Table 5 presents average annual practice expenses and the distribution of these expenses across inputs by location. The data indicate no significant difference in average total practice expenses across the three locations. Our regression analysis also finds that after controlling for specialty, there is no difference in average annual practice expenses across locations (see Table B.6). There are, however, a number of statistically significant differences in the distribution of expenses between urban and outlying county physicians. Compared with urban county physicians, outlying county physicians have a significantly greater proportion of practice expenses composed of equipment, supply, and nonphysician payroll costs. Urban county physician practices have proportionately higher malpractice insurance expenses. There are no statistically significant differences in the distribution of practice expenses between adjacent and outlying county physicians and very few differences

Table 4

Average Fees For Selected Visits and Average Net Physician Income
By County Type

	Metropolitan ("Urban")	Nonmetropolitan Adjacent ("Adjacent")	Nonmetropolitan Nonadjacent ("Outlying")	Total
Follow-Up Hospital visit	$34.83[bc]	$25.35[a]	$25.71[a]	$33.06
SAMPLE SIZE	1490	124	229	1843
Office visit-New Patient	$58.52[bc]	$37.97[a]	$39.43[a]	$54.82
SAMPLE SIZE	1939	168	283	2390
Office visit-Established Patient	$31.54[bc]	$22.84[a]	$23.26[a]	$29.92
SAMPLE SIZE	1980	177	293	2450
Net Physician Income, 1985	$115,324[c]	$106,667	$99,929[a]	$113,226
SAMPLE SIZE	2568	189	312	3069

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

a. Mean is statistically different from Urban mean at 95 percent confidence level.

b. Mean is statistically different from Adjacent mean at 95 percent confidence level.

c. Mean is statistically different from Outlying mean at 95 percent confidence level.

Table 5

Average Percent Distribution of Physician Expenses by County Type

Expense Category	Metropolitan ("Urban")	Nonmetropolitan Adjacent ("Adjacent")	Nonmetropolitan Nonadjacent ("Outlying")	Total
Depreciation of Equipment	4.7%[c]	5.4%	6.5%[a]	5.0%
Medical Liability Insurance Premiums	15.6[bc]	11.9[a]	10.5[a]	14.7
Office Expenses	25.4[c]	23.2	22.3[a]	24.9
Total Nonphysician Payroll Expenses	28.4[bc]	33.0[a]	35.6[a]	29.6
Supplies and Material Expenses	8.6[bc]	10.4[a]	11.6[a]	9.1
Other Expenses	17.3[c]	16.1	13.4[a]	16.8
Average Annual Total Expenses, 1985	$103,777	$86,408	$110,546	$103,322
SAMPLE SIZE[1]	1350	120	196	1666

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

1. Only physicians who responded with complete information in all categories of expenses were included in this table.

a. Mean is statistically different from Urban mean at 95 percent confidence level.

b. Mean is statistically different from Adjacent mean at 95 percent confidence level.

c. Mean is statistically different from Outlying mean at 95 percent confidence level.

between urban and adjacent county physicians. However, quantitatively the distribution of expenses for physicians in adjacent counties is much closer to that found in outlying counties.

Turning to our analysis of Medicare and other third-party payer involvement, Table 6 reports Medicare participation rates, assignment rates, the percentage of Medicare fee coverage, and the distribution of revenues by payer. The 1986 SMS survey indicates that nationally 45.5 percent of physicians participate in Medicare [3]. This number is considerably higher than that reported by HCFA for 1986 (PPRC 1989 p. 357-369). HCFA reports physician participation rates of 28.4 percent in 1986 and 37.3 percent in 1988. HCFA defines "participation" as physicians who have signed a participation agreement. The wording of the AMA's questionnaire apparently resulted in a higher estimate of participation because it did not explicitly refer to a signed agreement. However, any errors are not likely to be correlated with county type and, therefore, should not alter our comparisons across county categories.

The AMA data indicate that urban county physicians have significantly higher participation rates than physicians in rural counties. Medicare participation rates in urban counties are 47.0 percent as compared with between 38 and 39 percent in rural counties. Regressions holding specialty constant also find that rural physicians have significantly lower participation rates than urban physicians (see Table B.7). Physicians who choose not to participate in Medicare have the option of accepting assignment on a case-by-case basis. Although the descriptive analysis indicates no significant difference in assignment rates across location, our regressions show that location is a significant factor in explaining assignment (see Table B.8).

Table 6

Medicare Participation Rates, Assignment Rates, Relative Payment Rates, and Distribution of Revenues by County Type

	Metropolitan ("Urban")	Nonmetropolitan Adjacent ("Adjacent")	Nonmetropolitan Nonadjacent ("Outlying")	Total
Medicare Participation Rates				
Yes	47.0%[bc]	38.7%[a]	37.5%[a]	45.5%
SAMPLE SIZE	2734	217	347	3298
Assignment Rates[1]				
Average Percentage of Medicare Services	28.4%	25.0%	23.9%	27.6%
SAMPLE SIZE	1284	124	201	1609
Percentage of Office Visit Fee Covered by Medicare				
Average Percentage of Fee Covered	69.8%	71.1%	70.8%	70.0%
SAMPLE SIZE	1712	138	225	2075
Sources of Revenue[2]				
Medicare	23.4%[bc]	27.0%[a]	27.3%[a]	24.1%
Medicaid	8.4[bc]	10.9[a]	11.9[a]	8.9
Blue Cross/Blue Shield and Other Third-Party Payors	45.0[bc]	37.9[a]	39.1[a]	43.9
Not Reimbursed By Third-Party Payors	23.2	25.2	21.5	23.1

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

1. Assignment rates are for nonparticipating physicians.
2. Sample size varies by source of revenue. Minimum sample sizes are: 2,336 metropolitan, 191 nonmetropolitan adjacent, and 302 nonmetropolitan nonadjacent.

a. Mean is statistically different from Urban mean at 95 percent confidence level.
b. Mean is statistically different from Adjacent mean at 95 percent confidence level.
c. Mean is statistically different from Outlying mean at 95 percent confidence level.

After controlling for specialty, nonparticipating outlying county physicians are less likely to accept assignment than nonparticipating urban county physicians. We find no difference in the percentage of the physician fee covered by Medicare across location.

There is considerable evidence indicating that participation and assignment rates are lower in rural areas. Rosenbach, Harrow, and Mitchell (1988) and Mitchell, Rosenbach, and Cromwell (1987) found that rural participation averages six percentage points lower than urban participation. Using 1985 BMAD data, Burney and Paradise (1987) note that the five states with the lowest participation rates were Idaho, Wyoming, Minnesota, South Dakota, and North Dakota. With the exception of Minnesota, these states were among the top six states with the highest concentrations of rural populations. Using BMAD data, PPRC concludes that primary care specialties (FP/GP) are less likely to participate and have lower assignment rates than medical or surgical specialists (PPRC 1988 p. 141-43). Rural areas have higher concentrations of general and family practice physicians. Using 1983 and 1985 BMAD data, Dor and Holahan (1990) found that rural areas exhibited consistently lower assignment rates than urban areas.

Table 6 also shows that rural county physicians are more dependent on public insurers for revenue. Both categories of rural county physicians receive a statistically greater percentage of their revenue from Medicare than urban county physicians. In urban counties, physicians report that approximately 23 percent of their revenue comes from Medicare as compared with 27 percent in rural counties. Our regression analysis controlling for specialty supports this conclusion (see Table B.9). Physicians in both rural county categories also receive statistically greater proportions of their

revenue from Medicaid (10.9 percent in adjacent counties; 11.9 percent in outlying counties) than physicians in urban counties (8.4 percent).

Conversely, urban county physicians receive a greater proportion of their revenues from Blue Cross/Blue Shield (BC/BS) and other third party payers (45 percent) than rural county physicians (between 38 and 39 percent). However, this difference is not the same across all private payers. Physicians in all three county types receive about the same amount of revenue from BC/BS (between 19 and 20 percent). But urban physicians receive a significantly greater proportion of revenue (24.7 percent) from other private third-party payers (e.g., commercial insurers and HMOs) than either category of rural physicians (18.4 percent in adjacent counties; 20.4 percent in outlying counties). There are no statistical differences in the proportion of revenues received from the patient across county types.

As mentioned above, we chose to re-examine selected variables to determine whether differences between urban and rural physicians vary with the degree of Medicare involvement. There are two reasons to examine differences by degree of Medicare dependency. First, physicians who have caseloads composed largely of the elderly may have fundamentally different practices. Second, Medicare policymakers may regard differences between urban and rural physicians who treat large numbers of Medicare patients as more relevant. The following analysis re-examines selected physician characteristics across county types within Medicare "dependency" groups.

Tables 7, 8, and 9 suggest that Medicare dependency affects some of the relationships observed above, but not others. The average fees reported in Table 7 indicate that regardless of the level of Medicare dependency, urban physicians charge higher fees than rural physicians. On the other hand,

Table 7

Average Fees for Selected Visits and Average Physician Income by Medicare Dependency[1] and County Type

	High Dependency (30-100%)			Low Dependency (0-9%)			
		Nonmetropolitan			Nonmetropolitan		
	Metropolitan ("Urban")	Adjacent ("Adjacent")	Nonadjacent ("Outlying")	Metropolitan ("Urban")	Adjacent ("Adjacent")	Nonadjacent ("Outlying")	Total
Follow-up Hospital Visit	$34.39[bc]	$24.87[a]	$26.14[a]	$35.28[bc]	$24.95[a]	$27.31[a]	$32.82
SAMPLE SIZE[2]	556	46	90	356	22	49	1578
Office Visit - New Patient	$66.56[bc]	$41.70[a]	$41.94[a]	$53.46[bc]	$33.53[a]	$36.44[a]	$55.59
SAMPLE SIZE[2]	681	61	107	496	34	59	2029
Office Visit - Established	$32.74[bc]	$22.68[a]	$23.38[a]	$31.31[bc]	$22.82[a]	$25.02[a]	$29.99
SAMPLE SIZE[2]	695	63	113	503	34	59	2062
Net Physician Income Last Year	$130,116[c]	$116,938	$108,738[a]	$99,173	$88,270	$79,661	$115,021
SAMPLE SIZE[2]	792	80	126	676	37	59	2562

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

Note: Because there is no practical way to report statistical differences between means for both location and Medicare dependency in the same table, the Medicare dependency significance tests are not reported. Measures of statistical differences between Medicare dependency category means are used to inform the discussion.

1. Medicare dependency defined by percentage of revenues from Medicare.
2. Individual sample sizes do not sum to total sample size because "medium dependency" group is excluded from table.

a. Mean is statistically different from Urban mean at 95 percent confidence level.
b. Mean is statistically different from Adjacent mean at 95 percent confidence level.
c. Mean is statistically different from Outlying mean at 95 percent confidence level.

Table 8

Average Annual Total Expenses and Distribution by Expense Category by Medicare Dependency[1] and County Type

	High Dependency (30-100%)			Low Dependency (0-9%)			
		Nonmetropolitan			Nonmetropolitan		
	Metropolitan ("Urban")	Adjacent ("Adjacent")	Nonadjacent ("Outlying")	Metropolitan ("Urban")	Adjacent ("Adjacent")	Nonadjacent ("Outlying")	Total
Depreciation of Equipment	4.9%	6.4%	6.0%	5.1%	6.5%	5.3%	5.1%
Medical Liability Insurance Premiums	16.6[c]	13.3	10.8[a]	12.7	7.3	9.6	14.2
Office Expenses	26.0[c]	22.6	20.9[a]	27.4	24.9	24.2	25.2
Total Nonphysician Payroll Expenses	28.1[c]	29.9	35.9[a]	27.1[c]	35.9	35.9[a]	29.6
Supplies and Material Expenses	8.6	8.5	9.8	9.3	9.8	11.9	9.2
Other Expenses	15.9	19.3	16.5	18.5	15.6	13.1	16.7
Average Annual Total Expenses	$92,438	$84,611	$109,642	$104,893	$84,217	$106,154	$102,697
SAMPLE SIZE[2]	446	54	81	373	23	39	1536

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

Note: Because there is no practical way to report statistical differences between means for both location and Medicare dependency in the same table, the Medicare dependency significance tests are not reported. Measures of statistical differences between Medicare dependency category means are used to inform the discussion.

1. Medicare dependency defined by percentage of revenues from Medicare.
2. Individual sample sizes do not sum to total sample size because "medium dependency" group is excluded from table.

a. Mean is statistically different from Urban mean at 95 percent confidence level.
b. Mean is statistically different from Adjacent mean at 95 percent confidence level.
c. Mean is statistically different from Outlying mean at 95 percent confidence level.

Table 9

Medicare Participation Rates, Assignment Rates, and Relative Fee Coverage by Medicare Dependency[1] and County Type

	High Dependency (30-100%)			Low Dependency (0-9%)			
		Nonmetropolitan			Nonmetropolitan		
	Metropolitan ("Urban")	Adjacent ("Adjacent")	Nonadjacent ("Outlying")	Metropolitan ("Urban")	Adjacent ("Adjacent")	Nonadjacent ("Outlying")	Total
Medicare Participation Rates							
Yes	48.0%	41.7%	44.1%	39.9%[bc]	17.4%[a]	23.8%[a]	44.6%
SAMPLE SIZE[2]	952	96	152	501	23	42	2654
Assignment Rates[3]							
Average Percentage of Medicare Services	32.1%[c]	30.5%	23.5%[a]	25.5%	13.7%	29.2%	28.4%
SAMPLE SIZE[2]	462	54	80	286	18	31	1382
Fee Coverage							
Average Percentage of Fee Covered by Medicare	73.6%	72.3%	74.1%	62.2%	62.4%	61.4%	70.0%
SAMPLE SIZE[2]	758	72	117	274	14	22	1894

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

Note: Because there is no practical way to report statistical differences between means for both location and Medicare dependency in the same table, the Medicare dependency significance tests are not reported. Measures of statistical differences between Medicare dependency category means are used to inform the discussion.

1. Medicare dependency defined by percentage of revenues from Medicare.
2. Individual sample sizes do not sum to total sample size because "medium dependency" group is excluded from table.
3. Assignment rates are for nonparticipating physicians.

a. Mean is statistically different from Urban mean at 95 percent confidence level.
b. Mean is statistically different from Adjacent mean at 95 percent confidence level.
c. Mean is statistically different from Outlying mean at 95 percent confidence level.

Medicare dependency is associated with income in two ways. Among high dependency physicians, outlying county physicians earn less than urban county physicians. However, Table 7 also suggests that high dependency physicians consistently earn more than low dependency physicians regardless of location.

Table 8 indicates that the level of Medicare dependency does not affect average annual expenses -- we still find no differences across location. However, the distribution of inputs changes. After controlling for dependency there are virtually no differences between urban and adjacent county physicians and fewer differences between urban and outlying county physicians. Most notably, the differences in the proportion of expenses going to equipment depreciation and supplies between urban and outlying county physicians is eliminated. This latter outcome may be driven, in part, by the smaller sample size in Table 8.

Medicare dependency also plays a role in altering geographic patterns of Medicare participation and assignment. Among all physicians, Table 6 shows that participation rates are about 10 percentage points lower in rural counties than they are in urban counties. However, in Table 9 this statistical difference is only present for low dependency physicians. This suggests that the differences in participation rates across areas are driven by low dependency physicians. The data indicate that participation rates are higher for high dependency physicians and there are no statistical differences across areas. This suggests that physicians with heavy Medicare caseloads are more likely to choose payment certainty regardless of location. However, among high-dependency nonparticipants, there are significant differences in assignment behavior. In particular, nonparticipating outlying county physicians with heavy Medicare dependency are more likely to balance bill rather than accept Medicare allowed amounts as payment in full.

IV. DISCUSSION AND POLICY IMPLICATIONS

Before moving to the discussion, there are two points worth noting. First, we would urge caution in drawing definitive conclusions from this study which is primarily descriptive and based on one year of data. Instead, these findings suggest a number of issues that may arise in the face of Medicare physician payment reform. Second, the relative importance of the above results will depend on the readers' perspective. Rural advocates might highlight the fact that lower fees in outlying rural areas are associated with lower physician earnings, despite the fact that these rural providers have more Medicare patient visits than urban physicians. Medicare policymakers, alternatively, might view the comparable participation rates among high dependency Medicare providers as evidence that historical fee differentials have not imposed insurmountable barriers to access and that high Medicare dependency appears to be associated with higher incomes. We now turn to the potential issues raised by the results.

Generally, the payment reform package can be viewed as a three-part policy. First, there is a resource-based relative value scale fee schedule designed to raise fees for evaluation and management services and lower those for surgeries and procedures. This fee schedule will recognize at least some of the geographical differences in practice costs. Second, there will be volume performance standards intended to slow this rate of increase in expenditures by linking annual updates in the fee schedule to the rate of growth in service volume. Third, to insure that reductions in Medicare payment rates do not increase beneficiaries financial burdens, there will be limits on the amount that physicians can balance bill patients above the fee schedule.

In light of the specialty distribution, the fee schedule will raise average fees in rural areas. As has been pointed out by others (Christensen

and Harrison, 1989), this occurs because of the greater prevalence of specialties (i.e., general and family practitioners) whose fees will be increased. As the difference in fees is reduced, other things being equal, the observed differences in income between urban and rural areas are likely to fall. This could improve physician availability in currently underserved rural communities. However, the ultimate impact on physician incomes will also depend on how the fee schedule affects Medicare volume.

Currently rural physicians have lower fees but a higher volume of Medicare services, as measured by patient visits, than urban physicians. This higher volume could be composed of either more patients or more visits per patient. Using 1985 patient-level BMAD data, Dor and Holahan (1989) found that volume per beneficiary was lower in rural areas. Thus we believe that the higher Medicare volume per rural physician is the result of each physician seeing more patients as opposed to providing more services per patient.

A conventional supply response among rural physicians would be for fee increases to yield a greater level of output. However, volume could fall if rural physicians reduce the numbers of "induced" services -- to the extent that some are currently provided. If higher rural fees under the Medicare fee schedule lead to a reduction in rural Medicare volume per provider, the policy may not close the gap in income by as much as might be expected. On the beneficiary side, the higher copays that will be required as a result of the higher fees may cause patients to respond by demanding less care. Some of this could be offset by the new limits on balance billing and, possibly, rural physicians' increased willingness to accept assignment. However, recent evidence from Mitchell and Menke (1990) shows that the dual impact of fee increases and balance billing limits will disproportionately increase the

liability of rural beneficiaries [6]. Sixteen percent of rural beneficiaries will experience increases in out-of-pocket liabilities (copays and balance bills) of 20 percent or more as compared to 7 percent of urban beneficiaries.

Even if there is a relatively small volume response to the fee schedule, the present difference in Medicare visits and revenues between urban and rural physicians suggests that the volume performance standards may be a more significant concern in rural areas. The reason being that a larger share of rural physicians' patients and revenues come from Medicare, and any overrun of a national volume performance standard resulting in fee reductions will affect a greater proportion of rural physicians' revenues.

A uniform volume performance standard for both urban and rural physicians may not be a problem if the growth rates in volume between urban and rural areas are similar. However, the specialty distribution alone suggests that the rate of volume growth will be higher in urban areas. Holahan, Dor, and Zuckerman (1990) find that the growth in volume between 1983 and 1985 for cardiologists (38 percent), ophthalmologists (11 percent) and orthopedic surgeons (9 percent) far exceeds that for general and family practitioners (1 percent) and general surgeons (4 percent). If the differences in Medicare volume growth among specialties persist, then there will be differences in rates of growth between urban and rural areas. If this is viewed as inequitable, a uniform national standard may need to be discarded in favor of other sub-national standards (e.g., specialty, geographic area, or type of service).

The effect of the limits on balance billing included in the payment reform package are difficult to predict. By making balance billing less attractive, they could increase participation and assignment in all geographic areas;

physicians will no longer gain much by charging more than Medicare's allowed amount. Some providers, however, may view these limits as reason to simply treat fewer of these "lower-priced" Medicare patients. Patients are likely to respond to the reductions in balance billing by demanding more services; from the perspective of many patients prices will have been reduced. Increases in demand may be difficult for rural physicians to satisfy as they try to conform to volume performance standards. However, fee increases in rural areas should dampen some of this new beneficiary demand. The Mitchell and Menke (1990) findings suggest that rural beneficiary demand would be dampened because of their increased out-of-pocket liability.

While conclusions from a descriptive study must be viewed cautiously, it seems that differences among urban and rural areas in Medicare volume, participation, and assignment may affect physician responses to payment reform. In some cases, our analysis reveals potentially contradictory effects. For example, rural physicians (and beneficiaries) may benefit from higher fees, but fee reductions resulting from a uniform volume performance standard may have an offsetting impact on rural physician revenues. In addition, reductions in balance billing may increase beneficiary demand in rural areas making it more difficult for physicians in these areas to limit the growth in volume. This study suggests that identifying urban and rural provider responses to the fee schedule will be an important dimension of future studies of the payment reform policy.

PAGE NOTES

[1] The chi-square test for independence tests the null hypothesis that two variables in question are independent rather than related. The formula is:

$$\Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o is the frequency observed for a particular table cell and f_e is the frequency expected for the same cell. The national average serves as the expected frequency in computing the statistic for county category. Degrees of freedom are computed as (rows-1)*(columns-1).

[2] Patient visits refers to the number of encounters a physician had during the last complete week of practice by setting (office, hospital, etc.). The survey does not illicit the number of unique patients. If the same patient returns twice to a physician's office during the week, two patient visits have occurred. The reader can infer from this that the interpretation of this variable probably varies by setting. In the office setting the number of patient visits during the week is likely to represent individual patients, whereas in the hospital setting, patient visits are more likely to represent multiple visits to the same patient.

[3] Physicians who see Medicare patients have the option of becoming a Medicare participating physician. A Medicare participating physician agrees to accept assignment on all Medicare claims. Assignment refers to the beneficiary's assignment of right to payment by Medicare to the physician. In accepting assignment the physician is paid directly by Medicare and agrees not to collect from the patient any more than applicable deductibles and coinsurance.

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Appendix A

STANDARD ERRORS

Appendix Tables A.1 through A.8 report standard errors for Tables 2 through 9.

Table A.1

Standard Errors for Specialty, Board Certification, Type of Practice, and Employment Status by County Type
(see Table 2)

	Metropolitan ("Urban")	Nonmetropolitan Adjacent ("Adjacent")	Nonmetropolitan Nonadjacent ("Outlying")	Total
Physician Specialty[1]				
General Practice/ Family Practice	.57	2.93	2.35	.58
Internal Medicine/ Medical Specialties	.66	1.99	1.67	.59
General Surgery	.37	1.45	1.47	.36
Medicare Surgery	.45	1.45	1.14	.40
Other Surgery Subspecialties	.47	1.45	1.16	.42
Rad/Anesth/Path (RAPs)	.64	2.17	1.73	.58
Other Specialty	.81	2.63	2.09	.73
SAMPLE SIZE	3358	260	393	4011
Board Certification				
Certified	.79	3.07	2.46	.73
SAMPLE SIZE	3358	260	393	4011
Type of Practice				
Solo Practice	.84	3.10	2.50	.78
SAMPLE SIZE	3358	260	393	4011
Employment Status				
Self-Employed	.76	2.33	1.99	.69
SAMPLE SIZE	3358	260	393	4011

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

1. Medicare surgery includes ophthalmology and orthopedic surgery. Other surgery subspecialties includes such subspecialties as colon and rectal; neurological; plastic; and urological surgery. Other specialty includes such specialties as pediatrics; obstetrics-gynecology; psychiatry; and emergency medicine. Specialty differences across county type are statistically significant based on a chi-squared test of independence.

Table A.2

Standard Errors for Medicare and Non-Medicare Patient Visits Per Week Per Physician for Selected Medical Patient Visits, by County Type and Medicare Status (see Table 3)

	Metropolitan ("Urban")		Nonmetropolitan				Total	
			Adjacent ("Adjacent")		Nonadjacent ("Outlying")			
	Medicare	Non-Medicare	Medicare	Non-Medicare	Medicare	Non-Medicare	Medicare	Non-Medicare
Surgery								
Assists	.02	.03	.05	.06	.04	.05	.01	.02
Operations	.04	.09	.19	.24	.13	.20	.04	.08
Total Surgeries	.05	.10	.20	.25	.15	.22	.05	.08
Non-Surgery								
Patient visits in emergency room	.25	.67	1.13	2.65	.66	1.06	.23	.59
Patient visits on hospital rounds	.39	.58	1.31	1.05	1.36	1.32	.36	.50
Patient visits in office	.50	1.11	2.03	3.53	1.71	3.25	.47	1.01
Patient visits in other locations	.13	.24	.57	.26	.58	.36	.13	.20
Total patient visits - all non-surgical settings	.78	1.32	3.23	4.43	3.19	3.85	.77	1.21
SAMPLE SIZE	2116	2116	187	187	277	277	2580	2580

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

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Table A.3

Standard Errors For Selected Visit Fees and
Net Physician Income, by County Type
(see Table 4)

	Metropolitan ("Urban")	Nonmetropolitan Adjacent ("Adjacent")	Nonmetropolitan Nonadjacent ("Outlying")	Total
Follow-Up Hospital visit	.41	.70	.67	.35
SAMPLE SIZE	1490	124	229	1843
Office visit-New Patient	.91	1.61	1.65	.79
SAMPLE SIZE	1939	168	283	2390
Office visit-Established Patient	.32	.55	.49	.28
SAMPLE SIZE	1980	177	293	2450
Net Physician Income, 1985	$1,524	$4,473	$3,489	$1,355
SAMPLE SIZE	2568	189	312	3069

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

Table A.4

Standard Errors for Physician Expenses by County Type
(see Table 5)

Expense Category	Metropolitan ("Urban")	Nonmetropolitan Adjacent ("Adjacent")	Nonmetropolitan Nonadjacent ("Outlying")	Total
Depreciation of Equipment	.19	.85	.69	.18
Medical Liability Insurance Premiums	.49	1.23	.75	.42
Office Expenses	.48	1.69	1.11	.43
Total Nonphysician Payroll Expenses	.51	1.74	1.14	.46
Supplies and Material Expenses	.26	.83	.72	.24
Other Expenses	.46	1.74	.98	.41
Average Annual Total Expenses, 1985	$3,062	$6,063	$7,509	$2,671
SAMPLE SIZE[1]	1350	120	196	1666

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

1. Only physicians who responded with complete information in all categories of expenses were included in this table.

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Table A.5

Standard Errors for Medicare Participation Rates, Assignment Rates, Relative Payment Rates, and Revenues by County Type (see Table 6)

	Metropolitan ("Urban")	Nonmetropolitan Adjacent ("Adjacent")	Nonmetropolitan Nonadjacent ("Outlying")	Total
Medicare Participation Rates				
Yes	.95	3.31	2.60	.87
SAMPLE SIZE	2734	217	347	3298
Assignment Rates[1]				
Average Percentage of Medicare Services	.91	2.79	2.10	.80
SAMPLE SIZE	1284	124	201	1609
Percentage of Office Visit Fee Covered by Medicare				
Average Percentage of Fee Covered	.51	1.79	1.30	.46
SAMPLE SIZE	1712	138	225	2075
Sources of Revenue[2]				
Medicare	.42	1.43	1.09	.38
Medicaid	.25	.74	.61	.23
Blue Cross/Blue Shield and Other Third-Party Payors	.51	1.63	1.17	.46
Not Reimbursed By Third-Party Payors	.57	1.98	1.34	.51

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

1. Assignment rates are for nonparticipating physicians.

2. Sample size varies by source of revenue. Minimum sample sizes are: 2,336 metropolitan, 191 nonmetropolitan adjacent, and 302 nonmetropolitan nonadjacent.

Table A.6

Standard Errors for Se[illegible] Visit Fees and Physician Income
by Medicare D[illegible]dency[1] and County Type
(See Table 7)

	High Dependency (30-100%)			Low Dependency (0-9%)			
		Nonmetropolitan			Nonmetropolitan		
	Metropolitan ("Urban")	Adjacent ("Adjacent")	Nonadjacent ("Outlying")	Metropolitan ("Urban")	Adjacent ("Adjacent")	Nonadjacent ("Outlying")	Total
Follow-up Hospital Visit	.58	1.30	1.05	.91	1.55	1.83	.36
SAMPLE SIZE[2]	556	46	90	356	22	49	1578
Office Visit - New Patient	1.56	3.30	2.51	1.98	2.34	2.77	.87
SAMPLE SIZE[2]	681	61	107	496	34	59	2029
Office Visit - Established	.69	1.00	.91	.55	1.11	1.06	.31
SAMPLE SIZE[2]	695	63	113	503	34	59	2062
Net Physician Income Last Year	$2,905	$6,569	$5,931	$2,508	$7,728	$5,763	$1,485
SAMPLE SIZE[2]	792	80	126	676	37	59	2562

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

Note: Because there is no practical way to report statistical differences between means for both location and Medicare dependency in the same table, the Medicare dependency significance tests are not reported. Measures of statistical differences between Medicare dependency category means are used to inform the discussion.

1. Medicare dependency defined by percentage of revenues from Medicare.

2. Individual sample sizes do not sum to total sample size because "medium dependency" group is excluded from table.

Table A.7

Standard Errors for Physician Expenses by Medicare Dependency[1] and County Type
(see Table 8)

	High Dependency (30-100%)			Low Dependency (0-9%)			
		Nonmetropolitan			Nonmetropolitan		
	Metropolitan ("Urban")	Adjacent ("Adjacent")	Nonadjacent ("Outlying")	Metropolitan ("Urban")	Adjacent ("Adjacent")	Nonadjacent ("Outlying")	Total
Depreciation of Equipment	.32	1.51	.69	.41	2.34	1.23	.19
Medical Liability Insurance Premiums	.84	1.89	1.37	.77	1.65	1.40	.41
Office Expenses	.82	2.25	1.73	.92	5.03	2.26	.45
Total Nonphysician Payroll Expenses	.84	2.57	1.82	.92	4.94	2.18	.47
Supplies and Material Expenses	.46	.99	.98	.50	1.81	1.42	.24
Other Expenses	.70	2.76	1.96	.89	4.71	1.42	.42
Average Annual Total Expenses	$3,400	$10,074	$10,465	$5,829	$12,541	$14,558	$2,637
SAMPLE SIZE[2]	466	54	81	373	23	39	1536

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

Note: Because there is no practical way to report statistical differences between means for both location and Medicare dependency in the same table, the Medicare dependency significance tests are not reported. Measures of statistical differences between Medicare dependency category means are used to inform the discussion.

1. Medicare dependency defined by percentage of revenues from Medicare.

2. Individual sample sizes do not sum to total sample size because "medium dependency" group is excluded from table.

Table A.8

Standard Errors for Medicare Participation Rates, Assignment Rates, and Relative Fee Coverage by Medicare Dependency[1] and County Type
(see Table 9)

	High Dependency (30-100%)			Low Dependency (0-9%)			
		Nonmetropolitan			Nonmetropolitan		
	Metropolitan ("Urban")	Adjacent ("Adjacent")	Nonadjacent ("Outlying")	Metropolitan ("Urban")	Adjacent ("Adjacent")	Nonadjacent ("Outlying")	Total
Medicare Participation Rates							
Yes	1.62	5.06	4.04	2.19	8.08	6.65	.97
SAMPLE SIZE[2]	952	96	152	501	23	42	2654
Assignment Rates[3]							
Average Percentage of Medicare Services	1.46	4.17	2.92	2.16	7.45	6.77	.87
SAMPLE SIZE[2]	462	54	80	286	18	31	1382
Fee Coverage							
Average Percentage of Fee Covered by Medicare	.63	2.22	1.56	1.61	9.08	5.53	.48
SAMPLE SIZE[2] .	758	72	117	274	14	22	1894

Source: American Medical Association's 1986 Socioeconomic Monitoring System Survey.

Note: Because there is no practical way to report statistical differences between means for both location and Medicare dependency in the same table, the Medicare dependency significance tests are not reported. Measures of statistical differences between Medicare dependency category means are used to inform the discussion.

1. Medicare dependency defined by percentage of revenues from Medicare.
2. Individual sample sizes do not sum to total sample size because "medium dependency" group is excluded from table.
3. Assignment rates are for nonparticipating physicians.

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Appendix B

REGRESSION METHODS AND RESULTS

This appendix details the methods and results of the regression equations discussed in the body of the paper. We have chosen to present the methods and results in an appendix because the regressions are used primarily to buttress the descriptive results. As noted in the body of the paper, we immediately found that specialty and location are related. Tabular results presented by location without controls may also reflect the influence of specialty as well as other variables correlated with location. Thus we felt that at least a rudimentary attempt to examine the impact of location in the presence of specialty was in order.

In order to more robustly test the impact of location, we regressed the variables of interest on location, specialty, and a set of other relevant variables. Our purpose in estimating these regression equations is not to definitively test specific hypotheses. Rather, we wish to determine whether the results in our descriptive tables are significantly altered when the influence of other variables, primarily specialty, are controlled.

Eight regression equations are estimated. Five equations examining continuous dependent variables (e.g., Medicare visits per week) are estimated using OLS. Two equations examining qualitative dependent variables (e.g., Medicare participation) are estimated using logistic regression. In addition to location and specialty, the regression equations include age, sex, solo practice, medical school, and board certification. These variables are selected because they can reasonably be expected to be associated with location.

Four of the independent variables included in the equations have more than two categories: location, specialty, age, and medical school. In order to avoid perfect multicollinearity, a decision to omit one category for each of these variables must be made. The omitted category for location is urban physicians. Thus, the parameter estimates for adjacent and outlying county physicians are interpreted as differential parameters relative to the omitted urban category. Similarly, the parameter estimates for the specialty, age, and medical school variables in the equations are interpreted in relation to the omitted categories of general practitioners, age 35 and younger, and private medical school, respectively. Note that for the purposes of the regression analysis specialty was collapsed from a seven category variable to a four category variable (i.e., general and family practice, medical specialties, surgical specialties, and other specialties).

The remainder of the appendix is organized into tables. Table B.1 presents the dependent and independent variable definitions. Tables B.2 through B.9 present the results of the eight regression equations discussed in the body of the paper.

Table B.1

Variable Definitions

Variable	Definition
Dependent Variables	
SOLO	1 if physician is in solo practice; 0 otherwise [1]
HOURS	Total hours worked per week
VISITS	Total number of Medicare patient visits per week
NETYEAR	Net income preceding year
EXPYEAR	Practice expenses preceding year
MCPART	1 if physician is now participating in Medicare; 0 otherwise
NASSIGN	Percentage of Medicare patient services assigned, nonparticipating physicians only
MEDICARE	Percentage of revenue from Medicare
Independent Variables	
PCTMCARE	Percentage of office visit fee covered by Medicare
DUMADJ	1 if county is nonmetropolitan adjacent to an MSA; 0 otherwise
DUMREM	1 if county is nonmetropolitan nonadjacent to an MSA; 0 otherwise
DUMSP2	1 if physician specializes in medical specialties; 0 otherwise
DUMSP3	1 if physician specializes in surgical specialties; 0 otherwise
DUMSP4	1 if physician specializes in other specialties; 0 otherwise
CERT	1 if physician is board certified; 0 otherwise
SEX	1 if physician is female; 0 otherwise
DUMAGE2	1 if physician is 36-45 years old; 0 otherwise
DUMAGE3	1 if physician is 46-55 years old; 0 otherwise
DUMAGE4	1 if physician is 56-65 years old; 0 otherwise
DUMAGE5	1 if physician is 65 years or older; 0 otherwise
DUMSCH2	1 if physician attended a public medical school; 0 otherwise
DUMSCH3	1 if physician attended a foreign medical school; 0 otherwise

[1] Solo practice is used as an independent variable in all other regression equations.

Table B.2

Logistic Regression Results:
Solo Practice (SOLO)

Variable Name	Parameter Estimate	Standard Error	Chi-Squared
INTERCEPT	0.35436	0.23882	2.20
PCTMCARE	0.00738	0.00220	11.27**
DUMADJ	0.20051	0.18747	1.14
DUMREM	0.20104	0.15083	1.78
DUMSP2	-0.14958	0.15267	0.96
DUMSP3	0.06131	0.14325	0.18
DUMSP4	-0.54131	0.14710	13.54**
CERT	-0.35108	0.10515	11.15**
SEX	-0.22943	0.18971	1.46
DUMAGE2	0.40170	0.13334	9.08**
DUMAGE3	0.43672	0.14665	8.87**
DUMAGE4	0.82710	0.15518	28.41**
DUMAGE5	1.21173	0.22814	28.21**
DUMSCH2	-0.10056	0.10417	0.93
DUMSCH3	0.46295	0.13351	12.02**

Model Statistics:
Percentage of cases classified correctly: 59.8%
Chi-square: 135.61 with 14 degrees of freedom**

* significant at .05 level
** significant at .01 level

Table B.3

OLS Regression Results:
Total Hours Worked for Week (HOURS)

Variable Name	Parameter Estimate	Standard Error	T-Statistic
INTERCEPT	66.18384	2.03784	32.477**
PCTMCARE	-0.03984	0.01833	-2.174*
DUMADJ	1.24413	1.55250	0.801
DUMREM	1.82246	1.25914	1.447
DUMSP2	1.23977	1.27813	0.970
DUMSP3	-2.00714	1.19584	-1.678
DUMSP4	-4.99312	1.22679	-4.070**
SOLO	-0.14310	0.78945	-0.181
CERT	-1.42819	0.88548	-1.613
SEX	-6.10587	1.57562	-3.875**
DUMAGE2	-0.48726	1.10612	-0.441
DUMAGE3	-1.48545	1.22432	-1.213
DUMAGE4	-3.43858	1.29842	-2.648**
DUMAGE5	-10.97890	1.86904	-5.906**
DUMSCH2	-0.07089	0.87593	-0.081
DUMSCH3	0.49027	1.12227	0.437

Model Statistics:
Adjusted R-square: .04
F value: 6.850**

* significant at .05 level
** significant at .01 level

Table B.4

OLS Regression Results:
Total Number of Medicare Patient Visits Per Week (VISITS)

Variable Name	Parameter Estimate	Standard Error	T-Statistic
INTERCEPT	28.31158	5.36260	5.279**
PCTMCARE	0.17695	0.04884	3.623**
DUMADJ	11.52329	4.08392	2.822**
DUMREM	15.06144	3.26741	4.610**
DUMSP2	9.92084	3.06328	3.239**
DUMSP3	-15.67040	2.86959	-5.461**
DUMSP4	-10.23360	3.95177	-2.590**
SOLO	-0.73339	2.09053	-0.351
CERT	2.99784	2.35672	1.272
SEX	-19.05510	4.46760	-4.265**
DUMAGE2	6.17289	2.87815	2.145*
DUMAGE3	6.34847	3.24854	1.954*
DUMAGE4	-0.63087	3.41786	-0.185
DUMAGE5	-3.06880	4.85192	-0.632
DUMSCH2	4.09696	2.31291	1.771
DUMSCH3	2.29945	3.07804	0.747

Model Statistics:
Adjusted R-square: .1036
F value: 12.461**

* significant at .05 level
** significant at .01 level

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Table B.5

OLS Regression Results:
Net Income Preceding Year (NETYEAR)

Variable Name	Parameter Estimate	Standard Error	T-Statistic
INTERCEPT	63828.72	9792.777	6.518**
PCTMCARE	4.76	88.287	0.054
DUMADJ	-3744.85	7635.090	-0.490
DUMREM	-12209.70	5943.185	-2.054*
DUMSP2	17239.36	6119.742	2.832**
DUMSP3	56564.99	5687.435	9.946**
DUMSP4	41559.08	5796.439	7.170**
SOLO	-15064.30	3726.189	-4.043**
CERT	25257.53	4227.547	5.975**
SEX	-34234.70	7351.130	-4.657**
DUMAGE2	21636.18	5224.963	4.141**
DUMAGE3	33240.26	5792.125	5.739**
DUMAGE4	20323.57	6138.068	3.311**
DUMAGE5	-7636.43	9168.885	-0.833
DUMSCH2	2730.52	4175.326	0.654
DUMSCH3	3038.59	54476.692	0.558

Model Statistics:
Adjusted R-square: .1599
F value: 22.630**

* significant at .05 level
** significant at .01 level

Table B.6

OLS Regression Results:
Practice Expenses Preceding Year (EXPYEAR)

Variable Name	Parameter Estimate	Standard Error	T-Statistic
INTERCEPT	99228.41	15981.269	6.209**
PCTMCARE	-133.27	144.180	-0.924
DUMADJ	-11461.70	11515.709	-0.995
DUMREM	2562.12	9293.514	0.276
DUMSP2	-10345.40	9791.672	-1.057
DUMSP3	31886.46	8973.858	3.553**
DUMSP4	-15353.90	9345.875	-1.643
SOLO	-31937.70	6028.801	-5.298**
CERT	10631.67	6785.561	1.567
SEX	-32986.90	13211.235	-2.497**
DUMAGE2	18828.52	8718.645	2.160*
DUMAGE3	21273.43	9415.966	2.259*
DUMAGE4	29264.35	9897.251	2.957**
DUMAGE5	7791.70	13997.977	0.557
DUMSCH2	17845.88	6590.356	2.708**
DUMSCH3	-1680.21	8528.588	-0.197

Model Statistics:
Adjusted R-square: .0765
F value: 8.222**

* significant at .05 level
** significant at .01 level

Table B.7

Logistic Regression Results:
Physician Participation in Medicare (MCPART)

Variable Name	Parameter Estimate	Standard Error	Chi-Squared
INTERCEPT	0.15065	0.24102	0.39
PCTMCARE	0.00064	0.00216	0.09
DUMADJ	-0.36655	0.18763	3.82*
DUMREM	-0.32300	0.15164	4.54*
DUMSP2	-0.04952	0.15170	0.11
DUMSP3	0.07373	0.14255	0.27
DUMSP4	0.40026	0.14593	7.52**
SOLO	-0.44556	0.09378	22.57**
CERT	-0.18505	0.10484	3.12
SEX	0.26593	0.18776	2.01
DUMAGE2	0.06603	0.13133	0.25
DUMAGE3	-0.16559	0.14542	1.30
DUMAGE4	0.10060	0.15387	0.43
DUMAGE5	0.43750	0.21932	3.98*
DUMSCH2	-0.28372	0.10306	7.58*
DUMSCH3	0.56578	0.13376	17.89*

Model Statistics:
Percentage of cases classified correctly: 59.9%
Chi-square: 105.19 with 15 degrees of freedom**

* significant at .05 level
** significant at .01 level

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Table B.8

OLS Regression Results:
Medicare Assignment Rate
Nonparticipating Physicians (NASSIGN)

Variable Name	Parameter Estimate	Standard Error	T-Statistic
INTERCEPT	49.33222	5.27431	9.353**
PCTMCARE	-0.06222	0.04810	-1.294
DUMADJ	-3.75932	3.72024	-1.010
DUMREM	-6.48813	2.95249	-2.198*
DUMSP2	-0.35815	3.07757	-0.116
DUMSP3	11.01798	2.88241	3.822**
DUMSP4	6.03600	3.09256	1.952*
SOLO	1.20382	1.95309	0.616
CERT	-3.98079	2.23065	-1.785
SEX	1.41919	4.34715	0.326
DUMAGE2	-8.28930	2.74937	-3.015**
DUMAGE3	-13.14720	2.99965	-4.383**
DUMAGE4	-17.70170	3.22426	-5.490**
DUMAGE5	-16.44860	4.83056	-3.405**
DUMSCH2	-4.72959	2.14591	-2.204*
DUMSCH3	4.92533	3.08652	1.596

Model Statistics:
Adjusted R-square: .0606
F value: 5.570**

* significant at .05 level
** significant at .01 level

Table B.9

OLS Regression Results:
Percentage of Revenue from Medicare
(MEDICARE)

Variable Name	Parameter Estimate	Standard Error	T-Statistic
INTERCEPT	6.80870	2.37501	2.867**
PCTMCARE	0.18020	0.02162	8.336**
DUMADJ	4.24487	1.83939	2.308*
DUMREM	5.33929	1.45772	3.663**
DUMSP2	16.33363	1.47897	11.044**
DUMSP3	5.08320	1.39014	3.657**
DUMSP4	6.10256	1.41998	4.298**
SOLO	-1.09392	0.91678	-1.193
CERT	3.99469	1.03970	3.842**
SEX	-1.93671	1.87660	-1.032
DUMAGE2	-0.54774	1.29535	-0.423
DUMAGE3	-1.53031	1.42801	-1.072
DUMAGE4	-1.56126	1.52230	-1.026
DUMAGE5	5.73549	2.13806	2.683**
DUMSCH2	-0.60649	1.02116	-0.594
DUMSCH3	4.81118	1.31497	3.659**

Model Statistics:
Adjusted R-square: .1238
F value: 18.796**

* significant at .05 level
** significant at .01 level

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